ABSTRACT OF THE INVENTION

The invention relates to a process for removing hydrogen sulfide, other sulfur-containing compounds and/or sulfur and mercury from a gas stream contaminated with mercury, hydrogen sulfide or both. The method comprises the step of selective oxidation of hydrogen sulfide (H_2S) in a gas stream containing one or more oxidizable components other than H_2S to generate elemental sulfur (S) or a mixture of sulfur and sulfur dioxide (SO_2). The sulfur generated in the gas stream reacts with mercury in the gas stream to generate mercuric sulfide and sulfur and mercuric sulfide are removed from the gas stream by co-condensation.